

REMARKS

Claims 1-3 remain pending after amendment.

Applicants' Invention

By way of review, applicants' claim 1 is directed to an olefin block copolymer having a ratio M_w/M_n of not more than 1.5, and which copolymer comprises:

(i) a polymer block comprising ethylene and an α -olefin of 3 to 20 carbon atoms, having a molar ratio (ethylene/ α -olefin) of ethylene units to α -olefin units of from 20/80 to 65/35, a weight average molecular weight of 50,000 to 2,000,000, and having a slope of an intramolecular composition distribution of absolute value of 0.1 to 0, and

(ii) a polymer block comprising ethylene and an α -olefin of 3 to 20 carbon atoms, having a molar ratio (ethylene/ α -olefin) of ethylene units to α -olefin units of from 70/30 to 85/15, a weight average molecular weight of 10,000 to 400,000, and having a slope of an intramolecular composition distribution of absolute value of 0.1 to 0.

Applicants' specification at page 12, lines 18-22 teaches that "to detail the slope (CD) of the intramolecular composition distribution, the larger the value, the broader the intramolecular composition distribution, and the smaller the

value, the narrower the intramolecular composition distribution".

The olefin block copolymer of the present invention accordingly comprises two polymer blocks (i) and (ii). Polymer block (i) contains ethylene in an amount of 20-65 mole %, while polymer block (ii) contains ethylene in a greater amount of 70-85 mole %. Both polymer blocks have a very narrow intramolecular composition distribution.

Such characteristics enable the claimed block copolymer to function with advantage as a viscosity index improver in lubricating compositions.

Applicants' claimed invention is neither disclosed nor suggested by the cited prior art.

Rejection under 35 USC 103(a)

Claims 1-3 stand rejected under 35 USC 103(a) as being unpatentable over Ver Strate et al U.S. Patent No. 4,804,794.

In support of the rejection, the Examiner states at page 4 of the Official Action:

"The difference between the present claims and Ver Strate is that the reference does not disclose a weight average molecular weight for each individual segment. It would have been obvious to one of ordinary skill in the art to consider that during the polymerization process for producing the (a) block polymer and (b) block polymer the amount of the monomers can be controlled for the purposes of obtaining the

desired average molecular weight of the first block polymer (a) and a second block polymer (b) for using a said block copolymer as lubricating oil additive. Because reference discloses a block copolymer having the same chemical formulation, the same utility of using, the same $M_w/M_n = 1.5$ and the minimum and maximum weight average molecular weight of the block copolymer is overlapping the weight average molecular weight of a block copolymer in the present claim 1.

Also, reference does not disclose a slope of an intramolecular composition distribution having absolute value of 0.1 to 0. . . . It would have been obvious to one of ordinary skill in the art to consider that the desired intramolecular compositional distribution value of 0.1 to 0 could be obtained in Ver Strate because the process conditions for producing ethylene-alpha-olefin copolymers are controlled and reference discloses that alpha-olefin copolymers having very narrow MWD and having specific intramolecular CD can be made by direct polymerization".

The rejection of the Examiner respectfully is traversed.

The Ver Strate reference discloses copolymers of ethylene and at least one other alpha-olefin monomer, *where the copolymer comprises intramolecularly heterogeneous copolymer chains* containing at least one crystallizable segment of methylene units and at least one low crystallinity ethylene-alpha-olefin copolymer segment. The at least one crystallizable segment comprises at least about 10 weight percent of the copolymer chain and contains an average ethylene content of at least about 57 weight percent, and wherein the low crystallinity segment contains an average ethylene content *not greater than* about 53 weight percent. The copolymer also has a molecular weight

distribution characterized by at least one of a ratio of M_w/M_n of less than 2 and a ratio of M_z/M_w of less than 1.8, and wherein at least two portions of an individual intramolecularly heterogeneous chain (each portion comprising at least 5 weight percent of said chain) differ in composition from one another by at least 7 weight percent ethylene (see claim 1).

Ver Strate also discloses at column 12, lines 12-48 that the copolymer is preferably made in a tubular reactor, and these copolymer chains are therefore tapered in composition and intramolecularly heterogeneous.

The intramolecularly heterogeneous chain of Ver Strate means that the chain has a broad (not narrow) intramolecular composition distribution as explained below.

Applicants' Figure 1 shows a slope (CD) of an intramolecular composition distribution of a polymer having two blocks of the present invention.

A method to determine a slope of an intramolecular composition distribution is described at page 13, line 6 through page 16, line 11 of the specification.

From Figure 1 and the Examples of the specification, it is obvious that, in the copolymer of the present invention comprising two polymer blocks, each polymer block has a slope (CD gradient) of an intramolecular composition distribution of absolute value from 0.1 to 0 as defined in the present claim 1.

On the contrary, an intramolecular composition distribution of the copolymer of Ver Strate is shown in Figures 7 to 17 of the reference to be distinct from that claimed.

The copolymer shown in Figures 7-15 and 17 of the reference comprises two or more copolymer segments having nearly identical ethylene content, and each segment has a broad (not narrow) intramolecular composition distribution of ethylene judging from the slope of ethylene content vs. fractional length along contour chain.

In the above case, the CD gradient of each segment cannot be determined because a portion of the same ethylene content extracted in the different segments precipitates simultaneously in the solvent fractionation, whereas that of the present invention can be determined because the ethylene content of each segment differs from each other.

Concerning the CD gradient of the copolymer of Ver Strate as shown in Figure 7, it can be roughly calculated as being 0.2 - $(72.5 \text{ wt\%} - 52.5 \text{ wt\%}) / (100 \text{ wt\%})$ - although it has to be calculated in the range of 90 wt% as described in the specification.

The copolymers shown in Figures 8-13 are the same as those of Figure 7, and it can be said that the copolymers of the present invention and those of Ver Strate are completely

different from each other with respect to the value of the CD gradient.

The copolymer of Ver Strate as shown in Figure 16 comprises two copolymer blocks having different ethylene content and is nearly the same as that disclosed in Example 3A in JP-B-6(1994)/96624 (corresponding to U.S. Patent No. 4,959,436), which is cited as Polymerization Example 4 in the specification.

The CD gradient determined with respect to the copolymer in Polymerization Example 4 is 0.17, which is clearly also outside of the range recited in applicants' claim 1.

The copolymers of Ver Strate as shown in Figures 14, 15 or 17 comprise two or more copolymer blocks having a slightly different ethylene content which is nearly the same as that disclosed in Example 3B in JP-B-6(1994)/96624 (corresponding U.S. Patent No. 4,959,436), which is cited as polymerization Example 3 in the specification.

The CD gradient determined with respect to the copolymer in Polymerization Example 3 was 0.11, and it is clearly outside of the numeral range recited in the present claim 1.

Moreover, comparing Example 1 with the use of a copolymer defined in claim 1 as a viscosity index improver and Comparative Examples 2 and 3 with the use of a copolymer prepared in Polymerization Example 3 and 4, respectively, it is apparent that, based on the lubricating properties of Ssi, CCS

viscosity at -20°C and MR viscosity at -30°C, the results of Example 1 are clearly superior to those of comparative Examples 2 and 3.

The cited reference thus fails to disclose both the claimed invention as well as the advantages provided thereby.

As a result, the rejection of claims 1-3 is without basis and should be withdrawn.

The application is accordingly believed to be in condition for allowance, and an early indication of same earnestly is solicited.


If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By 
Raymond C. Stewart, #21,066

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000


RCS/DWH/sh
1155-0275P